

 **KISCO**
CREATING COLORS AND CHEMICAL SOLUTIONS



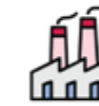
ABOUT KISCO GROUP



Experience
since 1971



Sales
\$US 370M
in 2021



Factories
11 manufacturing
plants



R&D
over
130 staff



Agents
over 60
countries



Employs
over
980 staff

Kyung-In Synthetic Corporation (KISCO) is a large-scale developer and manufacturer of dyes, inks, fine chemicals and other functional materials that has been operating for over 50 years.

KISCO has 3 subsidiaries, JMC, DKC and WISECHEM that together make up the KISCO group. The combined KISCO group has a market capitalization of around \$US300M and sales of over \$US370M in 2021. The group employs over 980 staff at 11 manufacturing plants in South Korea as well as one in Turkey. KISCO has over 130 R&D staff and is supported by representatives and agents in over 60 different countries. KISCO core values include safety, the environment, respect for people and delivering on our commitments to our customers.

KISCO has a track record of successful, long-term partnerships and extensive experience with establishing and managing joint ventures. Through these partnerships KISCO is constantly expanding our range of activities and working with our partners to open up new markets and new applications for our technologies. KISCO is based in Korea but its business is global.



KISCO Seoul Office

Iksan Factory

Yesan Factory

JMC

Incheon Factory

KISCO's name <Kyung-In>

Kyung-In refers to the region between Seoul and Incheon, Korea's major international airport. The Kyung-In region is home to thousands of companies providing ready access to a large range of suppliers and customers.

JMC Corporation

JMC (originally the Jeil Moolsan Company) was established in 1953 and is a world leader in the field of **saccharin and sulfur-based fine chemicals**. JMC was acquired by the KISCO group in 2004. JMC's research and development leverages the capabilities across the KISCO group and JMC provides raw materials for many other products manufactured by KISCO. JMC produces materials for **fluorescent pigments, resins, medicinal intermediates, electronics, plastics and agriculture**. JMC is also a large-scale manufacturer of the **world's highest quality saccharin**. Saccharin is a safe, artificial sweetener that enables a drastic reduction in sugar content. JMC supplies saccharin to some of the world's largest quality-oriented, multinational food and medicine producers.

Daito-KISCO Corporation (DKC)

Daito-KISCO (DKC) was jointly established by KISCO and Japan's DAITO CHEMIX Corporation in 2005 to manufacture and sell the core raw materials for photoresists used in display and semiconductor manufacturing processes. DKC produces and supplies photosensitive materials for displays such as LCD/OLED and high-resolution semiconductors to customers around the world. In 2019 DKC began the expansion of new production facilities with the construction of a plant in Iksan, Korea. Based on this, DKC intends to continue to expand its influence in the global electronic materials and photosensitive materials markets.

WISECHEM

WISECHEM is a joint venture company established by KISCO and Korea Alcohol Industry Co. Ltd in 2010. It is the first company in Korea to operate in the field of display and high-performance pigments. It supplies world-class pigments to manufacturers in Korea, Japan, China and Taiwan, which are the major countries involved in the display and semiconductor industry. WISECHEM has a complete product line of pigments applicable to various displays such as LCD, wOLED, and QD, and is building trust in the market by also providing excellent quality materials to the semiconductor area for use in applications such as image sensors. In addition, WISECHEM, through intensive investments in R&D, is expanding its business to applications such as automotive paints and pigments for printers.

PRODUCTS

Textile Dyes

Reactive, disperse and acid dyes as well as optical brightening agents that are used to color clothes all around the world

Papijet Inks

Inks for digital textile and UV printing. These new inks are changing the way textiles are colored and enabling 'fast fashion' and on-demand manufacturing of clothes and signage

Electronic Materials

Colorants for LCD color filters, photoinitiators for high precision electronics lithography and chemicals for displays and semiconductors that are all based on a deep knowledge of dyes and pigments

Fine Chemicals

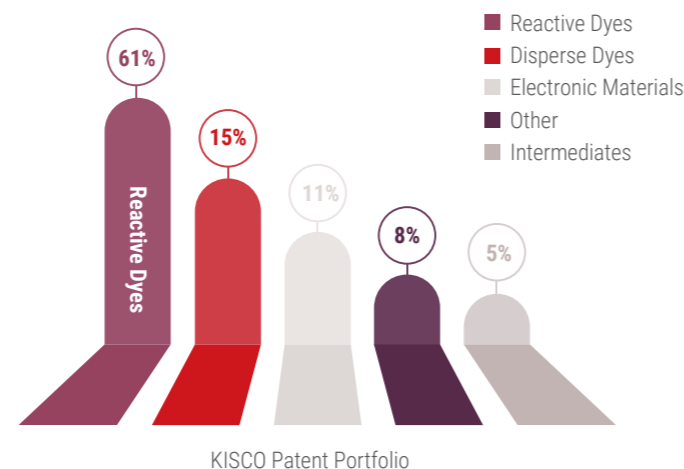
Chemicals and intermediates for food, beverages, medicines, pharmaceuticals and agriculture

RESEARCH AND DEVELOPMENT

Developing new materials and solving problems for our partners

KISCO founded the first center dedicated to dye research in Korea in the 1980s. The Central Research Center has grown to occupy 7 levels of the original KISCO building in Seoul and now employs over 130 research staff. Of these, 7 have PhDs and 64 have Masters degrees.

Research staff directly assist in the transfer of new processes from the Research Center to pilot and large-scale production facilities. KISCO is experienced at managing Intellectual Property (IP). Within the KISCO group some materials are manufactured under license and KISCO has protocols in place to manage its IP and that of its partners.



CAPABILITIES AND FACILITIES

KISCO creates colors and chemical solutions

KISCO can help to expand its partners' business into Korea and apply its extensive research and manufacturing capabilities to help develop new solutions and products.

Production and Business Practices

KISCO has the **scale and flexibility** to deliver high quality, globally competitively priced products. KISCO has reactors that range in size from 20 to 100,000 litres and delivers products to its customers **by the tonne or by the kilogram** depending on their application. KISCO's factories have storage and shipping facilities to accommodate large inventories and flexibility in domestic and overseas supply. KISCO also has in-house business development, legal and accounting staff to deal with both suppliers and customers. KISCO supplies agents, equipment manufacturers and other chemical companies.

KISCO has communication and management processes and a uses a commercial **Enterprise Resource Planning System (ERP)** that ensure all parts of the business are aware of their obligations under contracts that are signed.

KISCO undertakes **multi-step syntheses to prepare final products**. KISCO has established long-term supply agreements and has a proud history of high reliability at stable costs. KISCO began supplying many of its customers over 20 years ago and KISCO regularly handles fluctuations in raw material prices and supplier demand.

KISCO Analytical Labs

The KISCO analytical labs provide **on-site Quality Control (QC) and Quality Assurance (QA)** on all products. The KISCO analytical labs are accredited to international standards through the Korea Laboratory Accreditation Scheme (KOLAS). KISCO is accredited to conduct chemical tests for color fastness to light, water, laundering and use; detection of allergenous and carcinogenic dyes; detection of APEOs, NPEOs, phthalate, aromatic amines, chlorinated aromatics, azo colorants, phenols, chromium, formaldehyde and heavy metals in textiles and leathers.

Production Capacity

- Lab and production-scale flow reactors
- 40,000 tonne p.a. of textile dyestuffs
- 3,000 tonne p.a. of digital textile inks
- 3,600+ tonne p.a. of saccharin
- 100,000 tonne p.a. of other fine chemicals
- 420 reactors

Chemical Reactions

1. Chlorosulfonation / sulfonation: $\text{ArH} \rightarrow \text{ArSO}_2\text{Cl}, \text{ArSO}_3\text{H}$
2. Halogenation: $\text{R-OH} \rightarrow \text{R-Cl}$ (X=halogen), $\text{Ar-H} \rightarrow \text{Ar-X}$ (X=halogen)
3. Cyanation: $\text{Ar-X} \rightarrow \text{Ar-CN}$, $\text{RCOX} \rightarrow \text{RCO-CN}$
4. Esterification: $\text{R-OH} + \text{R'COX} \rightarrow \text{ROCOR'}$
5. Nitration and reduction: $\text{Ar} \rightarrow \text{Ar-NO}_2 \rightarrow \text{ArNH}_2$
6. Oxime formation: $\text{RCOCH}_2\text{R}' \rightarrow \text{RCOCH=N-OH}$
7. Benzoin condensation: $2\text{ArCHO} \rightarrow \text{Ar-CH(OH)-CO-Ar}$
8. Friedel Craft acylation: $\text{ArH} + \text{Ar'COX} \rightarrow \text{ArCOAr'}$
9. Friedel Craft alkylation: $\text{ArH} + \text{RX} \rightarrow \text{ArR}$
10. Oxidation
11. Phthalocyanine ring formation
12. Metal complexation
13. Pyrazine ring formation
14. Suzuki coupling: $\text{ArB(OH)}_2 + \text{Ar'X} \rightarrow \text{Ar-Ar'}$
15. Grignard coupling: $\text{Ar-MgBr} + \text{R-X (or CO)} \rightarrow \text{Ar-R (or Ar-CH(OH)R)}$
16. Buchwald-Hartwig reaction: $\text{Ar-NH}_2 + \text{Ar'-X} \rightarrow \text{Ar-NH-Ar'}$
17. Kumada reaction: $\text{Ar-X} + \text{Ar'-MgBr} \rightarrow \text{Ar-Ar'}$
18. Chloromethylation: $\text{ArH} \rightarrow \text{ArCH}_2\text{Cl}$
19. Radical polymerization
20. Polyester binder polymerization
21. Acrylic monomer synthesis
22. Boronylations
23. High temperature reactions, upto 260°C
24. Electronic materials with <10ppb impurities, analysed on site



CHEMICAL CASE STUDIES

KISCO makes chemicals for clothes, foods and electronic devices

SACCHARIN

CHEMICAL CASE STUDY

Saccharin is an artificial sweetener that has been used for over one hundred years as a sugar substitute. Saccharin tastes around **500 times sweeter than sugar** which means that it can be used in small amounts to reduce sugar consumption. Saccharin is commonly found in **table top sweeteners**, candies, cookies, some formulations of soft drinks as well as in **mouth washes** and as part of the tablet coating in **medicines**.

Saccharin has been extensively studied and both the US FDA and EPA have conclusively declared it **safe for consumption**. Current global health standards only regulate saccharin for impurities based on the Remsen-Fahlberg synthesis route, first developed over 100 years ago. However, many other manufacturers use an alternative synthesis route that can give rise to other impurities and by-products. Saccharin made by the alternative route can therefore comply with the standards but still contain significant impurities. JMC manufactures saccharin via the Remsen-Fahlberg route using mainly water-based processes and its own starting materials. JMC has on-site analysis facilities that **test for all possible contaminants**.

JMC produces the **world's highest quality saccharin**. This is in line with the approach across the KISCO group; JMC produces high quality materials that are **safe for its workers and its customers**. JMC has been proudly manufacturing saccharin at its plant since 1954 and is now applying this experience to an increasing range of **sulfur-based chemicals** for use in applications such as **fluorescent pigments**, resins, medicinal intermediates, electronics, plastics and agricultural materials.



CHEMICALS FOR ELECTRONICS

CHEMICAL CASE STUDIES

In order to make the leap into being a high-tech chemicals company, KISCO has focused on research and development on materials for **OLEDs**, lithography process **materials for semiconductors**, **monomers for Colorless Polyimide (CPI)** and **graphene-based materials**. KISCO has also developed close partnerships to support the development and maintain the localization of these important raw materials.

Some of KISCO's specific research directions include the development of new emissive layer (EML) and common layer (HTL/ETL) material intermediates and process **materials for OLEDs**. KISCO's focus is on manufacturing materials with **high purity** and high reliability, based on its core capability in organic synthesis. KISCO is also developing and producing materials, including small molecules, monomers and polymers, for photo resists, photo initiators, photoactive compounds and photo acid generators for excimer lasers.

With respect to monomers for CPI, through the support of the Korean government's 'World Premier Materials (WPM)' program, KISCO has succeeded in mass-producing the **core monomer**, which is the most important material for **flexible displays**, using its own process expertise. This is playing a key role in maintaining the localization of this important technology.

Graphene has been attracting attention for a long time as a dream material with excellent mechanical and electrical characteristics. However, due to difficulties in mass production and high price structures, graphene has not yet been widely commercialized. JMC has recently completed research on the **mass production of graphene oxide** and is working on a joint patent application with a Cornell University research team around materials for rechargeable batteries and engineering plastics.



THE FUTURE

KISCO is continually developing new production facilities and product lines

NEW FACILITIES

INVESTING TO GROW



To enable the continued expansion of its research, development and production activities, KISCO is investing in the construction of over **125,000m² of new facilities** in the Iksan 3rd General Industrial Complex, located less than 2 hours from Seoul. This began in 2018 and the first stage opened in Q1 2020.

By investing in its people, its processes, its materials and its facilities, KISCO plans to continue to lead the development and localization of the next generation of materials for electronics.

Other recent plant expansions undertaken by the KISCO Group include:

New Electronics Production Facility

KISCO's Building C facility was opened in 2017 and features **14 reactors**, all equipped with glass-lined vessels and transfer lines to ensure the highest purity materials for electronics.

Expansion of JMC BCMB factory

In 2019 JMC opened a **new, 545m² dedicated facility** for the production of BCMB. BCMB is an important component in semiconductor encapsulents.



GROWING PARTNERSHIPS

EXPANSION AND DIVERSIFICATION

To expand its range of product lines KISCO has developed a **new partnership** with Australian-based fine chemical developer **Boron Molecular**. KISCO, along with the **CSIRO**, Australia's national research agency, are joint shareholders in Boron Molecular. This has cemented a relationship that spans early research and development through commercialisation to large-scale production.

Boron Molecular was formed as a spin-out company from CSIRO to commercialise a suite of process patents on organic molecules called boronic acids. Boron Molecular has since developed extensive experience in the large-scale manufacturing of **RAFT agents**, chemicals that enable the synthesis of precision polymers. Boron Molecular also manufactures a range of **small molecules for pharmaceuticals, materials for energy applications** as well as **chemicals for electronics**. Boron Molecular has a fully integrated operation in **North Carolina, USA** to complement its research, development and manufacturing facilities in **Melbourne, Australia**.

In announcing the partnership, KISCO CEO and President, Dr Sung Yong Cho, said that "CSIRO is a powerhouse of chemistry research. Boron Molecular have the technology translation skills and work closely with CSIRO in Australia. KISCO has always invested in research and development and we have the facilities to manufacture at scale. Together we can reach global markets with these technologies".

PEOPLE AND THE ENVIRONMENT

KISCO values its people and the planet

Environment, Health and Safety

KISCO is committed to manufacturing using **sustainable processes** that do not harm its **employees** or the **environment**. Every KISCO site is audited for waste and better all legislated standards on air emissions and wastewater discharges. KISCO regularly undertakes internal, government-mandated and customer-initiated audits of all of our facilities.



Employee Welfare

KISCO values its **employees** and actively supports the **health, well-being and development** of its staff. KISCO applies **fair work conditions** across the entire group of companies and actively enforces policies to **prevent social or gender-based discrimination**. KISCO has been repeatedly recognized for **labor management excellence** through a number of awards from the Korean Government.

SUSTAINABILITY

KISCO contributes to and complies with global standards for product safety

Product Stewardship and Safety

KISCO has certifications for ISO14001 and OHSAS18001. Our food products, from JMC, are accredited under the **Food Safety System Certification** and are certified as **Kosher and Hallal**.

KISCO is certified under the **Global Organic Textile Standard (GOTS)** and is a **bluesign system partner** and a **ZDHC contributor**. KISCO's products are included in **The List by INDITEX**.

KISCO, along with the leading textile chemical manufacturers, is a **founding member of the Sustainable Chemistry for the Textile Industry (SCTI)** group.

KISCO's production sites have systems for **IQC, PQC, OQC and QA** and an **MES system** to manage all materials and processes.



DOING BUSINESS IN KOREA

Korea has a modern, growing economy and is a country that values innovation



Korea has a modern, growing economy and is a country that offers many advantages to businesses and has a government that actively supports trade and innovation. KISCO has been designated as a "World Class 300 Company" by the Korean Government.



Korea has a population of 50 million and is one of the world's top-10 economies in terms of foreign reserves, exports and total trade.



Korea is home to more than 15,500 foreign-invested companies and is at the center of Asia, a gateway to the region's more than 1.5 billion consumers.



Korea is ranked 5th in the World Bank's Ease of Doing Business Index and is the highest-ranked G20 country, ahead of the USA, UK, Germany and Japan.

Korea is the most innovative country in the world, according to the Bloomberg Global Innovation Index published in January of 2021. Korea scored exceptionally highly in this ranking of 215 countries for patent activity, manufacturing capability, high-tech density, tertiary efficiency and R&D intensity.

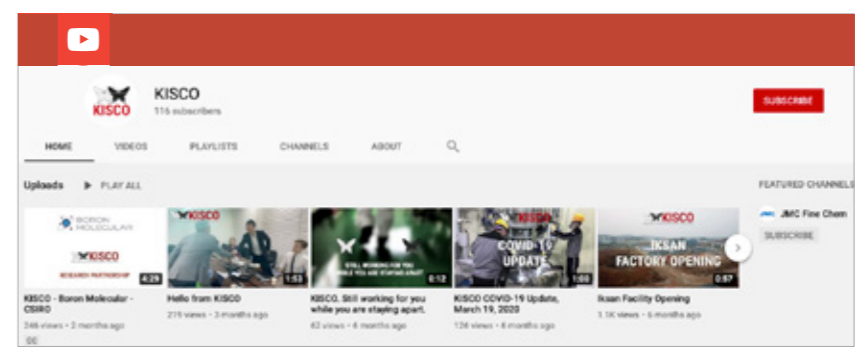
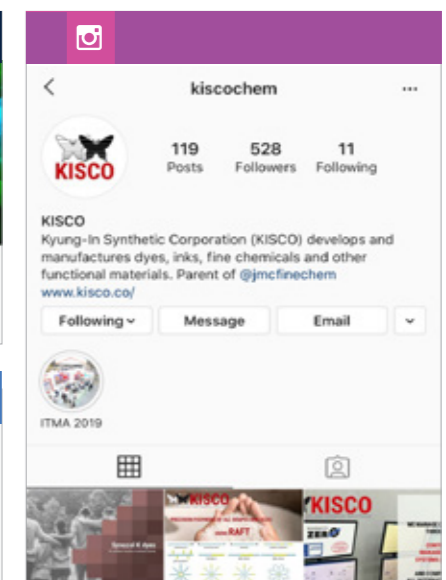
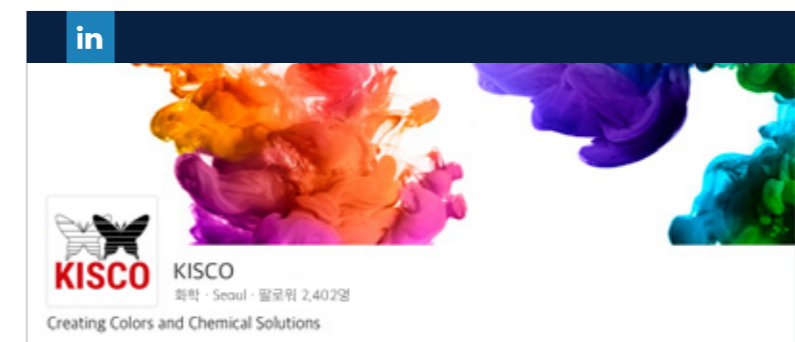
For Korea, business is global. Korea is the only Asian economy to have Free Trade Agreements (FTAs) with all three of the world's largest markets – the United States, European Union, and China. Korea recently concluded agreements with China, Canada, New Zealand and Vietnam, expanding Korea's global FTA network to 52 countries that together account for more than 73% of the global GDP.

Korea is a global manufacturing leader in areas including semiconductors, electronics and chemicals. This success stems from Korea's partnerships with countless companies worldwide to create global value chains.

Korea has a robust system of intellectual property enforcement and patent examination times that are significantly shorter than in the US and Japan.

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ROADMAP TO
ZERO

